

CLAIMS

1. A ferromagnetic powder composition comprising soft magnetic iron-based core particles wherein the surface of
5 the core particles are surrounded by an insulating inorganic coating, and a lubricating amount of a compound selected from the group consisting of silanes, titanates, aluminates, zirconates, or mixtures thereof.
2. A composition according to claim 1 wherein the
10 compound has at least one hydrolysable group and at least one lubricating organic moiety.
3. A composition according to claim 1 or 2 wherein the compound is present as a lubricating layer on the insulated particles.
- 15 4. A composition according to any one of the claims 1-3, wherein the compound has the following general formula:



wherein M is a central atom selected from Si, Ti, Al, or
20 Zr,
R₁ is a hydrolysable group,
R₂ is a group consisting of a lubricating organic moiety, wherein the sum of m+n is the coordination number of the central atom;
25 n is an integer ≥1 and
m is an integer ≥1.
5. A composition according to claim 4, wherein R₁ is an alkoxy group having less than 12, preferably less than 6 and most preferably less than 3 carbon atoms

6. A composition according to claim 4, wherein R₁ is a chelate group.

7. A composition according to claim 6, wherein the chelate group is a residue of hydroxyacetic acid (-O(O=C)-CH₂O-) or a residue of ethylene glycol (-OCH₂CH₂O-).

5 8. A composition according to any of claims 4-7, wherein R₂ is an organic group including between 6-30, preferably 10-24 carbon atoms, and optionally including one or more 10 hetero atoms selected from the group consisting of N, O, S and P.

9. A composition according to claim 8, wherein the R₂ group is linear, branched, cyclic, or aromatic.

10. A composition according to any of claims 8-9, wherein 15 the R₂ group is a chain selected from the group consisting of alkyl, ether, ester, phospho-alkyl, phospho-lipid, or phospho-amine.

11. A composition according to claim 10, wherein the R₂ is selected from the group consisting of phosphato, 20 pyrophosphato or phosphito.

12. A composition according to any one of the claims 1-10, wherein the compound is selected from the group 25 consisting of alkyl-alkoxy silanes and polyether-alkoxy silanes.

13. A composition according to any one of the preceding claims, wherein the compound is selected from the group consisting of octyl-trimethoxy silane, hexadecyl-

trimethoxy silane, polyethyleneether-trimethoxy silane,
isopropyl-triisostearyl titanate, isopropyl-
tri(dioctyl)phosphato titanate, neopentyl(diallyl)oxy-
trineodecanoyl zirconate, neopentyl(diallyl)oxy-
5 tri(dioctyl)phosphato zirconate, and diisobutyl-
acetoacetyl aluminate.

14. A composition according to any one of claims 1-13,
wherein the insulating inorganic coating of the iron-
based particles is phosphorous based.

10 15. A composition according to any of claims 1-14,
wherein the iron-based core particles consist of
essentially pure iron.

16. A composition according to any of the claims 1-15
wherein less than 5% of the iron-based core particles have
15 a size below 45 μm .

17. A composition according to any one of the claims 1-
16, wherein at least 40% and preferably at least 60% of
the iron-based core particles consist of particles having
a particle size above about 106 μm .

20 18. A powder composition according to any one of the
claims 1-17 wherein at least 20%, preferably at least
40%, and most preferably at least 60% of the iron-based
core particles consist of particles having a particle
size above about 212 μm .

25 19. A composition comprising a compound according to any
one of the claims 1-18, wherein the amount of the
compound is present in an amount of 0.05-0.5%, preferably
0.07-0.45%, and most preferably 0.08-0.4% by weight.

20. A composition according to any of claims 1-19, which is optionally mixed with additives, such as particular lubricants, binders or flow-enhancing agents.

21. Process for the preparation of soft magnetic composite materials having a density of at least 7.45 g/cm³ comprising the steps of

- providing an iron or iron-based powder composition according to any one of the claims 1-20;
- uniaxially compacting the obtained soft magnetic powder composition in a die at a compaction pressure of at least about 800 MPa; and
- ejecting the green body from the compaction tool; and
- optionally heat-treating the compacted body.

15 22. Process according to claim 21, wherein the compaction is performed at a pressure of at least about 900 MPa, more preferably at least 1000 MPa, and most preferably above 1100 MPa.

20 23. Process according to claim 21 or 22, wherein the particle size of the iron core powder is as defined in any one of the claims 16-18.